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ABSTRACT

This booklet, one of a series intended to apply economic principles to major social and political issues of the day, focuses on the relationship between growth of the money supply, growth of productivity, and inflation. Provided first is a definition of inflation along with discussions of price indexes, the value of money, and the concept of money-velocity in relation to inflation. As causes of inflation, the energy crisis and monopolies are briefly examined and rejected. Equations are developed to consider what determines price level, what determines the rate of inflation, and how things like oil and regulation affect inflation, and the conclusion is reached that growth of the money supply beyond the growth of productivity is the root cause of inflation. The section dealing with the cure for inflation covers: (1) the relationship between money and unemployment; (2) the relationship between an increasing rate of inflation and the reduction of unemployment; and (3) some problems with the solution to inflation, (defined as a reduction in the money supply and possibly a return to money that is convertible into a commodity, such as gold). (IS)

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I. Introduction

For the decade 1955 to 1965, the inflation rate in the United States was less than 2 percent per year. With inflation this low, you would imagine that no one was concerned with inflation. Quite the opposite was in fact the case! There was genuine concern that the steady increase in the price level was going to result in serious trouble sooner or later. Much of this concern was misguided, but the worry over the impact of inflation on economic activity was not.

The United States has now experienced almost 20 years of inflation at rates above those normally associated with a peacetime economy (in the United States, at least). In fact, the rate of inflation during 1980 reached 18 percent for the first quarter and was in excess of 13 percent for the entire year. Since 1980, the rate of inflation has gradually decreased to the 1983 level of about 4 percent. Concern over $200 billion deficits in the federal budget, however, have not allowed the expectation of inflation in our future to wane.

While rates of inflation of 15-20 percent are not uncommon in other parts of the world, we in the United States are not used to prices changing this fast. For example, in 1983 the inflation rate in Brazil was 125 percent per year, and for the decade 1973-83, inflation in Brazil averaged 100 percent per year. The rate of inflation in the United States has fluctuated during the last 15 years between 4 percent and 13 percent, but significantly, each new peak has been higher than the last. Is the recent decline just another chapter in the rising inflationary tide? Does the almost steady rise in the U. S. inflation rate mean that inflation is out of control? Are we at the mercy of the Middle East oil shieks? Are we doomed to a future where a hamburger will cost $1,000? The discussion that follows will try to answer all of these questions. In fact, it will do more than this in that a workable solution to the problem of inflation will be suggested.

II. What Is Inflation?

It may seem strange to ask a silly question such as, "What is inflation?" We all know what inflation is: prices that are going or have gone up. But what are prices? Sounds like another ridiculous question, doesn't it? Everyone knows that prices are just the number of dollars that it takes to buy something. Now, we're getting someplace. Prices are indeed the number of dollars it takes to buy something, but what something? Well, the something depends on which measure of the price level we are talking about. We've got to get this aspect of the inflation problem straight before we can proceed with the solution to inflation.

A. Price Indexes

There is a price index for everyone. If you don't like the inflation rate just give me a little time and I'll find a price index with an inflation rate you'll like better (Note I said *like better*, not *like*). The reason is simple. While the various price indexes are constructed differently, during a period of general inflation they all will go up. But why are they different? Why isn't there just one rate of inflation? Well, each index is meant to reflect the costs of purchasing those items purchased by a particular part of the economy.

How is a price index constructed? Start with a particular group of people, high school or college students, for example. Then find out what this group of people buys during an average year. That is, select a "market basket." The whole idea is similar to standing at the door of a supermarket and surveying the grocery carts as they come out of the store. The difference in this case is you're surveying more than groceries. But the idea is the same.

Once you have selected an appropriate "market basket," you must find out what it costs to purchase that market basket at a particular point in time, for example, Jan. 1, 1985. Let's call this date our "base" time. Then calculation of the price index is simple. Find out how much it costs to purchase the market basket every month or week if you want to keep track of prices on a weekly basis. Each new market basket cost is divided by the cost of the market basket at the base time (the cost of the market basket on our base date, Jan. 1, 1985).

The ratio of the cost of the market basket at any time and the cost of the market basket at the base time forms a price index. For example, if it cost $10,000 to purchase our bundle in January 1985 and $11,000 in January 1986, then our index is 1.10.

Now wait just a minute; this doesn't look like any price index I've seen in the papers, you say. True, the indexes reported in the paper are expressed in hundreds, such as 156 or 275, not as 1.10. The 1.10 is usually multiplied by 100 to eliminate the decimal point, making our index 110. But what does it mean? Well, it means that prices have gone up 10 per cent over the period from our base time to the last value of the

index, in our case one year. Or alternatively, that prices are now 110 per cent of prices at the base time.

Probably the price indexes you are most familiar with are the consumer price index ***(the CPI)*** and the wholesale price index ***(the WPI).*** These two indexes are reported in all the newspapers and radio and television newscasts. They are calculated by the Bureau of Labor Statistics and have a base time of 1967-1969. That is, they are based on what the "market basket" cost, on the average, during the three years 1967, 1968, and 1969. The Bureau of Labor Statistics periodically changes the base time of the index and often adjusts the "market basket" for changes in the consumption habits of consumers.

Other indexes with which you are less familiar but which nonetheless are important in the determination of economic policy are the GNP deflator, the agricultural price index and the producers price index. Each of these indexes are used in various aspects of government policy. The GNP deflator uses as its "market basket" the total of goods and services produced in the United States. The agricultural price index uses the "market basket" of goods purchased by farmers and is used in the computation of agricultural "parity" for purposes of determining farm price supports.

B. The Value of Money

As we have indicated above, prices are expressed in terms of money. That is, the price of bread is expressed in terms of the number of dollars it takes to buy a loaf of bread of a certain type. But how do we express the price of money? A ridiculous question, you say. The price of a dollar is surely just a dollar! Right you are. But in this case, knowing the price of money does you no good.

Surely there is a way to express something similar to the price of bread when it comes to money—for all other goods prices have meaning and are related to value. This is exactly the clue we are looking for: the value of money instead of its price. For other goods we are discussing value when we discuss price, but for money this just isn't the case. A dollar always costs a dollar, but it won't always buy the same amount of goods.

All right then, what is the value of money? It seems natural to express the value of money in terms of how much a unit of money will buy. This is the reasoning being applied when you read in your local newspaper that a dollar today is only worth a quarter. Obviously, a dollar is always worth a dollar. But, a dollar today might buy only as much as a quarter bought 15 years ago. In this case, a dollar now could be said to be the equivalent of a quarter 15 years ago.

Once again we can make use of the concept of a "market basket" of goods and services. We can express the value of money in terms of how many market baskets that a dollar will buy. Of course, in general a dollar

will not buy the entire market basket, but we can then speak in terms of the portion of a market basket that a dollar will buy. For example. if our market basket costs $10,000, a dollar will buy 1/10,000 of a market basket.

We can use the ideas we learned from our discussion of price indexes to get the idea of an index for the value of money. Recall that the price index for the base year is always 100 (the cost of the market basket on January 1, 1985 divided by the cost of the market basket on January 1, 1985 is always one). If we express the value of money index as (100/PI) × 100, where PI is a price index, we have a money index. For the base year, PI = 100. The money index for the base year is then (100/100) × 100, which is equal to 100. So for the base year the money index is 100. As the price index rises, say to 120, the money index falls to (100/120) × 100 = 87.5. Thus, at a price index of 120, the value of a dollar now is only 87.5 cents of a base year dollar.

It's clear then that the value of money is really just the reciprocal of the price level. We shall find this simple idea, that prices and the value of money are inversely (reciprocally) related, to be very useful in understanding inflation.

C. Understanding Inflation

It is amazing how such a simple thing as inflation can be misunderstood so easily. To understand inflation, we have to distinguish between the level of something and how fast the thing in question is changing (referred to as its rate of change). Inflation is the speed and direction of price changes. In this sense, inflation is very similar to velocity; that is, it is speed plus direction. When we tell someone the wind velocity we simultaneously tell them the direction of the wind and the wind speed. In the same way if I tell you that prices *fell 10 per cent* last year, I have told you the *speed* at which prices are changing (10 per cent per year) and the *direction* of the change in prices, in this case, down (yes, prices can go down).

The point of the above discussion is the price level does not represent inflation. It is the speed at which prices are changing that represents inflation or deflation. The distinction between the price level and the speed that prices are changing is important because much of the rhetoric concerning inflation concentrates on those things that affect the level of prices, not on those things that affect the speed at which prices are changing. For example, imagine yourself in your car on the road between Houston and Dallas. Two elements of your position are of importance to you. First, your position on the road (i.e., exactly where you are between Houston and Dallas); second, your velocity (i.e., your speed and direction).

What determines your velocity? Well, your direction is determined when you start. But what determines your speed? Several factors

contribute to your speed: throttle setting, engine size, wind conditions, etc. Assume you have set the accelerator so that you are cruising along at 55 miles per hour. Now assume a tornado picks up your car and sets it back down exactly five miles closer to Dallas. What has happened to your velocity? Nothing, you are still pointed in the direction of Dallas and traveling at 55 miles per hour, but your position on the road has changed. Things that change your position do not necessarily affect your velocity, unless we measure the difference between our position at one point in time and then at another and calculate our velocity from these measurements.

Using this latter approach, we might conclude that the speed and direction of our car are determined by tornadoes rather than the act of putting the pedal to the metal. The same kind of mistake can be make with inflation. We can mistake things that affect the level of prices on a once and for all basis as being the things that cause inflation, because we typically measure inflation as the change in the price level that occurs between two points in time. In this way, we catch the impact of things like our tornado and attribute to them causality regarding our speed when they actually only affect our position on the road.

If we want to eliminate inflation we must first understand what causes it. In the same way, if we want to stop the car, we don't stop tornadoes. We take our foot off the accelerator. We stop the car by stopping the flow of gas to the engine, and we stop inflation by stopping the flow of whatever is the equivalent of gas to the price level engine.

III. The Causes Of Inflation

If we read our newspapers we know that the high price of energy is one of the principal causes of inflation. Additional causes are excessive government regulation, monopoly, greedy labor unions, excessive government expenditures, budget deficits, etc. What would you say if I said that none of these is the cause of inflation? That removing all of them would not affect the rate of inflation one iota? Sounds incredible, doesn't it? But in a very real sense it's true. Each of these things affects the level of prices but not one of them affects the speed of price changes.

If these factors are not at fault in the inflation crime, then where does the blame lie? First we must search for something that is changing steadily, just as the flow of gasoline to the engine of our car. Energy prices cannot be the explanation because they really have risen significantly only twice in the past decade (once immediately following the Arab oil embargo in 1973, and again following the Iranian revolution in 1979). These two increases account for some 75 percent of the increase in the price of crude oil in the decade of the 1970s.

Even more important is the fact that the whole world has been affected by the so-called energy crisis, but rates of inflation differ

dramatically over the free world. For example, the rate of inflation in West Germany for the decade of the 1970s was less than 3.5 percent per year, yet West Germany imports some 95 percent of its crude oil. In Japan the '70s inflation rate was less than 4.5 percent per year and Japan imports 100 percent of its crude oil. On the other side of the coin, in Brazil the inflation rate for the '70s was 100 percent per year, and Brazil imports only 50 percent of its crude oil. The question is then, if the energy crunch is the cause of inflation, why aren't all countries affected to the same extent? It appears that we must search elsewhere for the answer.

Each of the other causes of inflation mentioned in the first paragraph of this section are similar to the price of crude oil in their effect on the price level. That is, each certainly affects the price level but each has only a transitory effect on the rate of inflation. Increased government regulation does indeed increase the cost of doing business and therefore will increase the price level but once this has happened no further increases in the price level should be expected unless regulation increases further.

Monopolies charge higher prices for goods than would be charged by competitive firms. The monopolist does this by producing less than a competitive industry. But monopolistic industry also uses fewer resources than a competitive industry would use, thus, a monopolistic industry leaves more resources for all other industries, so that while the monopoly industry has higher prices the other industries have lower prices.

Even if, on balance, monopoly results in higher prices, continuing increases in prices would require that the extent of monopoly increase every year. Moreover, if the extent of monopoly is increasing every year, is monopoly increasing faster in some years than in others? Is monopoly increasing faster in Brazil than in the United States? Is monopoly increasing faster in the United States than it is in either West Germany or Japan? Only if all of these coincidences are true can the monopoly explanation for inflation be a valid one. Since there is no evidence that any of these conditions are true we must search elsewhere for the cause of inflation.

A. What Determines the Price Level?

In our discussion of price indexes, we referred to prices as the number of dollars it takes to buy something, perhaps a "market basket." We could have expressed prices in terms of anything—hours of student time, bushels of wheat or cans of beer. Then the price level would be influenced by the amount of student time available or the wheat harvest or the output of beer. In particular, the more students that are looking for work, the more hours of work it will take to buy any "market basket" of goods. In the same way, the better the wheat harvest, the less a

bushel of wheat will buy. These simple statements reflect the "law of demand": the greater the quantity, the lower the value.

In a similar fashion, prices can be expressed in terms of money: the more money there is, the less money is worth. The less money is worth, the higher prices are because the value of money is inversely related to the prices of goods. Conversely, the more goods there are, the more money is worth and the lower the price level. Sometimes, this simple relation is expressed in a form called the "equation of exchange." This equation says that money, prices and goods are related in a particular way.

It will prove useful for us to state this equation of exchange:

Equation 1 $MV = Py$

In the equation, **M** stands for the total number of dollars in the hands of the public (the quantity of money), **P** stands for the price level (the Consumer Price Index, for example) and **y** stands for the quantity of goods and services produced in the economy.

The remaining element in the equation is **V**, and this item is referred to as the velocity of money. The velocity of money can be interpreted as the efficiency with which money can be used (or for example, how many times a dollar can be used in a year). If a new innovation in the use of money were to occur (for example, credit cards) that would allow us to carry on our business with less money, each unit of money could be used more often and **V** would rise. This rise in **V** says that a given amount of money can do more work. In fact, the product **MV** can be interpreted as the total amount of work that money can do.

In a similar fashion, the product **Py** (the total money value of goods and services produced) can be interpreted as the total amount of work that money must do. That is, the total value of the goods and services produced must move about the economy via the use of money. The left-hand side of the equation measures the total amount of work that the money can do and the right hand side measures the total amount of work to be done.

We can rewrite Equation 1 to show the relationship between the price level **P**, and the elements that determine the price level. The rewritten equation looks like this:

Equation 2 $P = (MV/y)$

The price level is then equal to the total number of dollars of work that the money stock can do, **MV**, divided by the amount of real work to be done, (the quantity of goods and services produced, **y**). This quotient gives us the price level at which the dollar value of work to be done is

exactly equal to the dollar value of work that the money stock can perform.

Using Equation 2 we can see anything that increases the dollar amount of work that the money stock can do will increase the price level. In contrast, anything that increases the real amount of work that money must do (the quantity of goods and services produced) will reduce the price level. This same simple relationship can be put differently. Since we have shown above that the price level is the price of goods in terms of money, we know that the quantity of money relative to the quantity of goods determines the price level. But this statement is simply saying in words what Equation 2 says in symbols.

For example, suppose that a new mutant corn seed suddenly appeared that doubles the yield of corn per acre. Now, for the same amount of work and resources, a farmer can raise twice as much corn. Under these circumstances, we would all expect the price of corn to fall. Or, put differently, the number of bushels of corn that it takes to buy a car would now be greater. Now it would take more corn to buy any given bundle of goods than it did before the new seed appeared. We could say that the price of goods in terms of corn has now risen. On the other hand, suppose that something happened that doubled the output of all goods other than corn. Then the amount of corn it would take to buy a given bundle of goods would fall so that the price of goods in terms of corn would have fallen.

This simple example is exactly what the equation of exchange tells us about money and prices. Increases in the amount of work that money can do, given the amount of goods and services produced (the amount of work to be done), will increase the price level and thereby lower the value of money. On the other hand, increases in the amount of work to be done (i.e., total goods and services) will decrease the price level because now the same money stock must do more work.

The amount of work money can do can be increased in two ways. The first is simply increasing the quantity of money in existence. More money can do more work. The quantity of money can be increased at will by the Federal Reserve System. The second way to increase the amount of work the money stock can do is to change the amount of it that is used. If each dollar can do more, then the money stock can do more.

Individuals can affect the amount of money it takes to do business in many ways, but we can summarize the reasons for such changes into two categories. First, changes occur in the way the payments system operates. Into this category fall the increase in the use of credit cards and electronic money transfers, both of which reduce the average amount of cash and money in checking accounts that individuals and businesses need to take care of their normal buying and selling. Second, individuals and businesses can watch their cash more closely to insure that they

keep on hand only the minimum necessary. In fact, individuals and businesses can rearrange their habits so that the amount of cash they have on hand is reduced. Of course, such diligence is costly, but under certain circumstances it is worth the effort.

What are the circumstances when individuals and businesses will find it worth their while to spend extra effort to economize on their holdings of money? One such situation occurs when money becomes extremely expensive to hold.

The cost of holding onto a dollar is what you could have earned had you invested the dollar in, for example, a savings account. Thus, the rate of interest on savings accounts or on other investments is one way of measuring a cost of holding money. For example, if the rate of interest paid on savings at your local bank is 10 percent, then by reducing your cash by an average of one dollar you can gain an additional 10 cents a year. Another cost occurs when there is considerable inflation. For when inflation occurs, money is losing value; the longer you hold it, the more you lose. In fact, during very rapid inflation, individuals try to spend their money as fast as they receive it.

B. What Determines the Rate of Inflation?

The discussion in the immediately preceeding section gives us a natural way of looking for the determinants of the rate of inflation. Remember that inflation is a constantly increasing price so that something must be constantly in change to generate a steady rate of inflation. Things that change once and for all only change the price level once and for all. If inflation is caused by changes in those things that only change once and for all, a steady rate of inflation could only be explained by asteady stream of once and for all changes. We can use the simple equationof exchange to explain these ideas further.

First, we must recognize that the equation of exchange must always hold. That is, the way we use money determines the amount of transactions that a single dollar can support (the **V** component of the equation of exchange). Given the **V** component of the equation of exchange, the price level must always be at the level that makes the equation of exchange an equality. We can then express the rate of inflation as a function of the components of the equation of exchange. For a given rate of inflation, let us assume that the **V** component is a constant. That is, for the moment, let us ignore changes in the market that cause changes in the amount of work that money can do.

Using this approach, we can write the equation of exchange using only the rates of growth in money, prices, and output. Essentially, the idea is that, because the price level is the price of goods in terms of money, the rate of growth in prices will be equal to the difference between the rate of growth in the money stock and the rate of growth in output (or the difference between how fast what money *can* do is

growing compared to how fast what money *has to* do). Using this idea, if output is growing just as fast as the stock of money is growing, there will be no inflation. The new money issued each year will be just enough to allow the bigger amount of goods and services to be exchanged. Of course, if something were to happen to make money more efficient, the price level will change. Once the change has worked itself out, the rate of inflation will settle back down to its former level.

Let's write this relation between the rate of inflation and the rates of growth in money and goods as:

Equation 3 $i = m - g$.

In Equation 3, **i** represents the rate of inflation, **m** represents the rate of growth in money, and **g** represents the rate of growth in the output of goods and services. Using Equation 3, we can discuss the various causes of permanent changes in the inflation rate. Keep in mind that any change affecting output or the amount of work that money can do will affect the price level. Any change in the price level will affect the measured rate of inflation until the change has had a chance to work itself out.

Look at Equation 3. What can cause inflation? First, having the money stock grow too fast certainly can. And the rate of growth of the money stock is controlled by the government, so the government is a possible culprit in the inflation mystery. Second, anything that slows the rate of economic growth will increase the rate of inflation. Increased government regulation possibly can slow the rate of technological change and thereby cause inflation. However, lower economic growth can cause inflation only if the rate of expansion in the money stock is maintained at a level greater than the rate of growth in output. The government always has the power to make the rate of growth in the money stock equal to the rate of growth in the capacity to produce goods and services.

From this discussion, we see that persistent inflation has to be the result of the money stock growing faster than output. Going back to the simple model of Equation 2, when the money stock grows faster than output for any period of time, the amount of money per unit of output increases. The price level is the price of goods in terms of money, and the price level rises because more money is available to purchase the existing amount of goods. Control of inflation will require, as a first line of attack, control of the rate of growth in the money stock. We will have more to say about this approach, but for now, suffice it to say that this is not as easy as it sounds.

C. How Do Things Like Oil and Regulation Affect Inflation?

If inflation is the result of money growing faster than output, why did the rate of inflation rise immediately after the 1973 oil crisis? Well, now we have to admit that our analysis in the above section requires the economy to be in what economists refer to as "the steady state." This means that all adjustments to outside influences such as an oil crisis have worked themselves out. But don't we always have some outside influence at work? Yes, but not all outside influences work in the direction of increasing the price level. Some outside influences, such as the oil crisis or a severe drought, clearly do contribute to higher prices. Others, such as an excellent harvest or a new large oil discovery, work in the other direction.

To see the effect of a reduction in the supply of oil (which is, after all, what the OPEC governments did in 1973 when they decided to produce less oil) on the rate of inflation, we must understand why a reduction in the supply of a critical material affects the price level. Recalling the equation of exchange (Equation 2), we can see the answer. The reduction in the quantity of oil reduces output, so that for any given quantity of money, the price level will be higher.

How do we get to the new higher price level? Well, certainly not instantaneously! But if not instantaneously, then any gradual changes will make the measured rate of inflation different then what we would have expected during the adjustment period. Since the new price level will be higher with a reduction in output, we will first have an acceleration in the rate of inflation. But, since ultimately the rate of inflation is determined by the rate of money growth as compared to the rate of output growth, the rate of inflation must return to its pre-OPEC level unless the reduction in oil production permanently affects our ability to improve technology. Thus, we expect a leveling off in the measured rate of inflation, and finally a reduction in the inflation rate.

If we were already at a steady rate of inflation when the oil crisis hit, we should have seen the rate of inflation rise, level off, and eventually fall back to the rate of inflation that existed before the oil crisis. That is assuming the Federal Reserve has kept a steady hand on the monetary throttle. If it hasn't, some of our analysis may turn out to be somewhat off the mark. An alternative approach would be to assume the rate of inflation will move with the rate of growth in the money supply, except for obvious outside influences, such as the oil crisis. If we do this, we can plot these numbers on a simple chart and test our hypothesis.

Figure 1 shows the rate of inflation and the rate of monetary growth for the 1965-1983 period. As is obvious from even casual observation, the rate of inflation tracks with the rate of monetary growth, except for two very significant periods: those surrounding the two oil crises of 1973

Money Growth and Inflation Rates Over Two Oil Crises

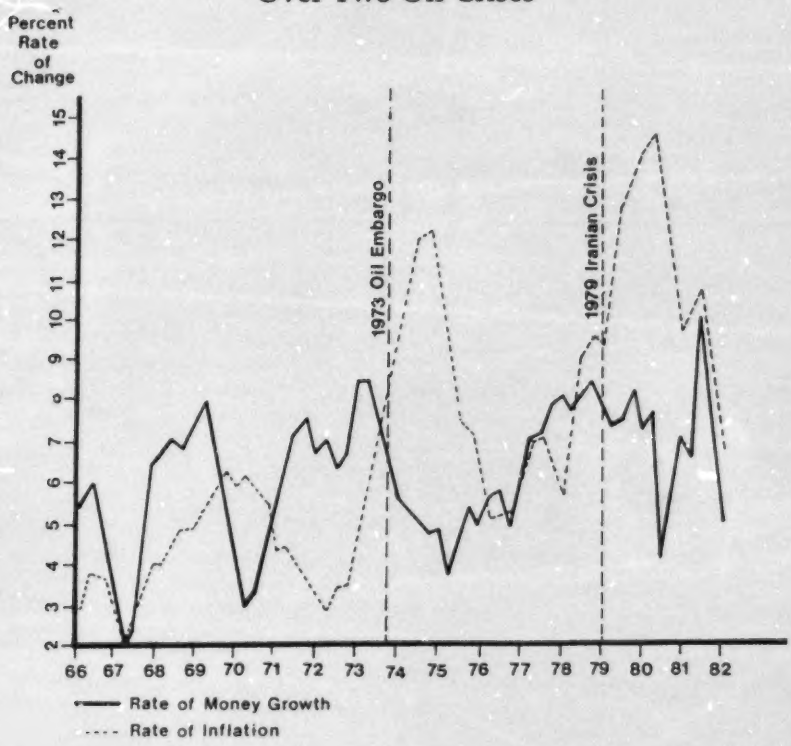

Figure 1

and 1979. For these periods, the rate of inflation does just what we have predicted. Immediately following each oil crisis, the rate of inflation increases dramatically. It then levels off and ultimately falls until it comes back in line with the rate of monetary growth.

It seems, then, that our theory works pretty well. While all sorts of outside influences occur, these outside influences have only temporary effects on the rate of inflation. Thus, in the final analysis, control of the rate of inflation depends upon controlling growth in the money supply. Such control is possible if we are willing to force the Federal Reserve to contain monetary growth. The problems that are involved in such monetary control will be the topic of discussion in the following section.

IV. The Cure for Inflation

Since the cure for inflation is so simple, why doesn't the Federal Reserve simply follow our directions and be done with it? Well, as we have indicated above, the solution is simple but the execution of it is not. First, rapid changes in the rate of growth of the money supply affect more than the rate of inflation, including the unemployment rate, which is certainly a significant consideration. Second, our monetary system is a mixture of a private and a public system. Thus, the Federal Reserve has control over the money supply, but not complete control, at least not in the short run.

A. Money and Unemployment

There is a definite connection between the growth of the money stock and the level of economic activity in the short run. By this, we mean that unanticipated changes in the growth of the money supply do cause changes in the economy. These changes are temporary in nature, but to those affected by them, their temporary nature is of little consolation. Where do these changes come from? Perhaps putting the analysis into a short story will help.

Picture yourself as the owner of a small grocery store. Assume that the rate of inflation is 10 percent per day and that this has been the rate of inflation for a considerable amount of time. Under these circumstances, everyone expects your prices to rise 10 percent each day. With all prices rising at 10 percent per day, employers will raise the wages of their employees by this same 10 percent per day. With everyone's wages rising by 10 percent per day, each person can just afford to purchase the same basket of goods from you that they have been purchasing in the past. In addition, the government must be increasing the money supply by 10 percent per day so that there is just enough money with which to conduct the ever-rising cost of purchasing your market basket.

Now, assume the government is displeased with a rate of inflation of 10 percent per day. (It is a little excessive, don't you agree?) Also assume that, like us, the government knows how to reduce the rate of inflation. Accordingly, they reduce the rate of growth in the money stock to 5 percent per day, but no one is told of the change (or alternatively, the government tells everyone, but—not surprisingly—no one believes them). The following day, you raise your prices by the usual 10 percent. All your customers expect you to do exactly that, so they are not surprised. What is a surprise, however, is that the money stock is not 10 percent bigger; remember, it only increased by 5 percent.

The fact that the money stock is only 5 percent bigger means that your customers have less money to bring to your store than they expected. The reduction in the rate of growth in the money stock also means that the government, if it is to keep its revenue equal to its expenditures (which it must do even if it does so by borrowing from us),

must adjust its expenditures, taxes, or borrowings to offset the loss of the revenue it was receiving from the missing 5 percent of the money stock. For the moment let us assume that the government simply hates borrowing. (A bit unrealistic, wouldn't you say?) In this case the government can either reduce its expenditures or increase taxes. Suppose government reduces expenditures in the form of a reduction in transfer payments (such as aid to education or social security payments).

Now, three things are different than they were yesterday before the change in government policy. First, the total supply of money relative to the work that money must do has fallen since the money supply has only risen by 5 percent and prices have risen by 10 percent. Second, the wealth of consumers in the economy is lower than they expected since the government only increased their money holdings by 5 percent rather than the usual 10 percent. Third, the income of some individuals (those who were the beneficiaries of the transfer payments) in the economy has been reduced.

All three of these events will reduce the amount of goods the public will purchase at your grocery store, even though each individual customer fully expected your usual 10 percent in prices. At the end of the day, you realize that your sales have fallen off and you must reduce your orders from your suppliers so as to avoid being overstocked. Your suppliers must in turn reduce their purchases from farmers and manufacturers.

The reductions in demand for the goods you sold in your grocery store will force the farmers and manufacturers to let some of their employees go so that unemployment will rise. Since the government has permanently reduced the rate of growth of the money stock to 5 percent these adjustments must continue until you, and your suppliers, are increasing prices by exactly 5 percent. When this occurs, sales will once again match your former orders and producers will have to rehire their formerly laid-off employees so that they can produce the necessary output. By this time, all wages will be rising at 5 percent per day, prices will be rising at 5 percent per day, and last, but certainly not least important, the money supply will be rising at 5 percent per day.

During the adjustment period, the reduction in orders will result in reductions in output, and possibly more important, there will be reductions in the level of employment so that unemployment will rise. The extent of the increase in unemployment will depend on the change in the rate of increase in the money stock and on the length of time the adjustment in expectations takes to accomplish. For example, there is considerable evidence that the abrupt decrease in the money supply that occurred in mid-1931 was the principal reason that the so-called Great Depression was so severe. Thus, it is not only that the public's expectations have not been met, but the extent of the surprise that is important

in terms of the effect of changes in the money supply on unemployment.

The contrast between the above discussion and another form of monetary change that results in significant changes in the rate of inflation and in the price level would be useful to discuss here. Throughout monetary history there have been periods of extreme inflation (sometimes referred to as hyper-inflation; inflation of more than 50 percent per month). These periods of extreme inflation are usually followed by a ***monetary reform.*** A monetary reform involves a revaluation of the currency and usually some form of guarantee that excessive monetary growth will not resume.

An important but not unique example is the hyper-inflation that occurred in Germany following World War I. As a condition of the peace settlement imposed by the Allies, the German government was required to pay substantial reparations payments to the victorious countries. For a variety of reasons that are not important here, the several German governments that were in power from 1919 to 1923 were unwilling or unable to raise sufficient revenue through taxation to meet their desired expenditures and the reparations payments. The result was that the German government, as had almost all governments before and since, resorted to financing the deficit through a speedup of the printing press.

Just a little nudge on the printing press accelerator should do it—but unfortunately the little nudge is never enough. In the German case the money stock was doubled in 1921 and rose tenfold in 1922. But these two years were nothing compared to 1923 when the money stock rose a staggering 400 billion times over its early 1923 quantity. In the month of August 1923 the price index rose to 12.6 times its July 1923 level; about 9 percent a day compounded. But there was still more inflation to come. In September the index rose more than 25 times its August level (about 11 percent a day) and then in October it rose to 296 times its September level; an inflation rate of more than 20 percent a day. Then in November the rate of inflation fell as the price level rose a mere 102 times its October level (a rate of only about 17 percent per day).

Things were so bad that workers were paid twice a day so that their children could immediately spend their first few hours earnings, because waiting until the afternoon could mean that pay would be reduced by 25 percent. The situation looked hopeless, but in December the price level less than doubled (1.7 times or only 1.9 percent per day) and then fell slightly and stabilized completely.

What brought on this remarkable change in the inflation rate, from more than 20 percent per day to 0 percent in only two months? First, "monetary reform" of October 15, 1923 created a new monetary unit, the Rentenmark. One new Rentenmark was equivalent to one trillion of the old paper Marks. At the same time, the Rentenbank took over the printing presses with positive limits put on the total note issue. Addi-

tional government borrowing via use of the printing press stopped. Without the printing press the government brought its budget into balance and the inflation stopped. Thus, the stopping of the runaway printing presses and the public's belief that the inflation would stop combined to stop the inflation almost immediately. Moreover, the inflation was stopped without any bad side effects. In fact the economy began to improve almost immediately.

What was needed to stop the inflation was the public's belief that the government would stop resorting to the printing presses to finance its budget deficits. The guarantee had to be believable—a naughty government has low credibility. In order to make their promises to slow the printing presses more believable, governments often make the new money convertible into something of known value (usually a precious metal such as gold or silver). In the German case convertibility was not imposed. The promise was made believable by the new central bank (the Rentenbank) being allowed to lend very little money to the government. Thus, the government would no longer have unlimited access to the printing presses.

Monetary reforms such as the one in post-World War I Germany frequently are accompanied by a revaluation of the country's currency. The revaluation of the currency in the case of Germany was necessary because the price of even basic food items had reached a level where a computer would have been necessary to calculate the grocery bill. Unfortunately, the computer had not yet been invented. When such a revaluation (a trillion to one in German case) occurs, the stores immediately adjust prices and no change in employment occurs because everyone expects the price and money change. This fact emphasizes the importance of expectations in the effect of changes in money policy.

B. Does Increasing Inflation Reduce Unemployment?

There is an additional issue that we have ignored up to this point, the so-called "Phillips Curve." The Phillips Curve is an empirical relation often observed but made famous in a paper by H. H. Phillips of Great Britain in 1962. The relation in question is that, historically, increases in the rate of inflation have been associated with decreases in unemployment, while decreases in the rate of inflation have been associated with increases in unemployment. These results are not surprising in the light of the above story. In particular, if the increase in the rate of monetary growth is unexpected, the response of the economy is exactly the opposite of that suggested in our story.

In our story, suppose that the government decided to double the rate of growth in the money stock from the original 10 percent per day to 20 percent per day. Once again, you would not know of the change in policy so you would raise prices your usual 10 percent. Your customers, also unaware of the change, would expect your prices to be 10 percent

higher. But the money supply is now growing at 20 percent per day, so that in the morning, each individual will have 20 percent more money than the day before. With this new money, everyone will buy more and you will run out of merchandise earlier than usual. You must now increase your orders and so must your suppliers. This new higher demand will result in an increase in output and employment.

In effect both producers and workers are fooled by the increased rate of monetary growth. Both expect that prices will continue to rise at their old rate of 10 percent per day. Once everyone realizes that the new rate of inflation is 20 percent per day then output will return to its old level and there will be no employment benefits of the increased inflation. In fact the increased inflation makes contracting more difficult unless individuals are absolutely certain about the level of future prices. In addition, some of the work in an inflationary economy is spent on devising ways to avoid the effects of the inflation. These resources could have been used to produce goods and services in the inflationless economy.

C. Some Problems With The Solution To Inflation

While it is simple to solve the inflation problem, the solution is not without its own problems. Is there a way for all of this to occur without the attendant adjustment costs? To see the answer to this question, we must understand why the adjustment costs occur in the first place. The first element in the adjustment is the surprise that results from the reduction in the rate of growth of the money supply. Then, we have the adjustment to the change in the government's revenue. Thus, the answer to the question requires us to investigate methods around the two significant changes that occur when we try to reduce inflation.

The first element in the adjustment process, the element of surprise associated with the new lower rate of growth in the money supply, can be eliminated by letting everyone know in advance about the change. But this is not enough, because the public must not only be told about the change, it must believe it is true. When a government has been increasing the money supply for some years, pronouncements that they are giving up this method of taxing the public are likely to fall on deaf ears. As we have seen above in the discussion of monetary reforms, past successful efforts at changing the public's expectations have required what might be called drastic measures. Such drastic measures have normally been in response to hyper-inflations such as the German experience discussed above.

We have referred to these successful efforts at changing the public's expectations as monetary reforms. Such reforms have been numerous over the world in the past several hundred years. They usually (possibly always) involve more than the promise by the government that it will do better. Typically, but not always, such reforms have included making

the new money convertible into some commodity. By convertible into a commodity, we mean that a person can take the money into a government office and get commodities instead of money. In this way, the value of money in terms of the commodity (possibly gold) is fixed, and the ability of the government to increase the money supply at will is removed.

The reason the government cannot increase the money supply at will when the money is convertible into a specific commodity is simple. As the money supply increases, the price of goods in terms of money rises. As goods become more expensive, money becomes cheaper. But money will always buy the same amount of the commodity into which it is convertible. Thus, money holders have an incentive to obtain money with goods, take that money to the government, and get the commodity the government has promised to convert the money into. In this way, any excess money issued by the government flows right back to the government as if it were attached to a rubber band.

One reason for the almost complete disappearance of convertibility in today's world is that the reserve commodities into which money is convertible must be stored by the government. Such storage is expensive as the commodity stored cannot be used and might be considered wasted. In addition, the value of a country's money would then depend on the value of the reserve commodity. For example, if the reserve commodity is gold, then gold discoveries would cause inflation because they would make gold more plentiful and thus worth less. On the other hand, the general growth of the world economy and the limited amount of gold would result, in the long run, in an increasing value of gold and thus a declining price level (in other words, persistent deflation), which is possibly no better than persistent inflation.

This storage of the reserve commodity essentially puts the country with convertibility at the mercy of the world market for the reserve commodity. Most countries believe they would like to pursue independent monetary policy, so the fact that convertibility prohibits such independent action is a strong reason for its abandonment. On the other hand, it is clear that there are costs in allowing governments to operate monetary systems without convertibility. These costs involve the historical fact that governments cannot be trusted to operate their monetary systems in a stable fashion.

Whenever a large increase in expenditures is required, such as a war, governments resort to printing money to raise revenue. Why is it so tempting for governments to turn to the printing press in times of fiscal need? There are at least two reasons for the printing press bias of government.

First, taxes are unpopular and their passage makes those responsible unpopular. It is so much easier to run the printing presses just a little faster. No one is the wiser. Until the people catch on, prices don't even

reflect the increased money stock. Eventually the faster press catches up with government in the form of increased inflation. But even then the government continues to reap revenue by supplying the additional money stock necessary to keep up with the rising prices.

Inflation can be reduced and even stopped as the years 1980 to 1984 so aptly demonstrate. For the five years before the Fall of 1980, the rate of inflation averaged 9.5 percent, with 1980 coming in at 11 percent. In the Fall of 1980, the Federal Reserve System began to reduce the rate of growth in the money stock from the average of 10 percent for the five years prior to the Fall of 1980 to an average of 5 percent for the 1981-1983 period. Inflation gradually fell from the 11 percent of 1980 to just under 5 percent in 1983. Note, however, that the reduction in the rate that money was growing was fast but the reduction in the inflation rate was much slower. As we have seen above, this difference is due to expectations and the public not believing the pronouncements of the government that they were now going to be good boys and girls. After all, government had made this same promise no less than 10 times in the preceeding 12 years!

What does the future hold? The large budget deficits have the potential for a renewal of the rapid monetary growth of the 1970s. This potential for inflation has been blamed as the cause of the persistence of high interest rates in spite of significantly lower inflation rates. The public simply expects that government must eventually bend to the pressure and finance these deficits with the printing press. If this is true, then the final solution to the inflation question must involve bringing the government budget into balance.

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